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PROBLEMS FOR SOLUTION.

ALGEBRA.

180. Proposed by R. D. CARMICHAEL, Anniston, Ala.

Find values of x , y , z , and u satisfying the equations

$$\begin{aligned}x + y + z + u &= 10 \dots [1], \\x^2 + y^2 + z^2 + u^2 &= 30 \dots [2], \\x^3 + y^3 + z^3 + u^3 &= 100 \dots [3], \\x^4 + y^4 + z^4 + u^4 &= 354 \dots [4].\end{aligned}$$

181. Proposed by A. H. HOLMES, Brunswick, Maine.

Sum the series, $1 + 2^m + 3^m + 4^m + \dots + n^m$.

182. Proposed by O. L. CALLICOTT, Gettysburg, S. Dak.

Find the value of $\sqrt[1]{2} \sqrt[3]{2} \sqrt[4]{2} \sqrt[5]{2} \dots \sqrt[1000]{2}$.

GEOMETRY.

313. Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

Prove that an algebraic curve of odd degree which is symmetrical with respect to a center has the center on the curve.

314. Proposed by F. ANDEREGG, A. M., Professor of Mathematics, Oberlin College, Oberlin, Ohio.

Find the area of the triangle bounded by the lines $l^a + m^b + n^r = 0$; $l'a + m'\beta + n'r = 0$; $l''a + m''\beta + n''r = 0$, where a stands for $x \cos a + y \sin a - p$, etc. [See Salmon's *Conic Sections*, 6th ed.]

315. Proposed by ROBERT E. MORITZ, Ph. D., University of Washington.

Given the area of the segment of a circle of given radius to find the length of the chord.

CALCULUS.

237. *Prize Problem. Proposed by S. A. COREY, Hiteman, Iowa.

Find an expression for the remainder after n terms in the following development† of $f(a+x)$:

$$\begin{aligned}f(a+x) &= f(a) + \frac{x}{m} \cdot 2 \left\{ f'(a+x) + f'(a) + 2 \left[f'' \left(a + \frac{x}{m} \right) + f'' \left(a + \frac{2x}{m} \right) \right. \right. \\&\quad \left. \left. + f'' \left(a + \frac{3x}{m} \right) + \dots + f'' \left(a + \frac{m-1}{m} x \right) \right] \right\} - \frac{B_1 x^2}{m^2 \cdot 2!} [f''(a+x) - f''(a)] \\&+ \frac{B_2 x^4}{m^4 \cdot 4!} [f^{iv}(a+x) - f^{iv}(a)] - \dots + (-1)^n \frac{B_n x^{2n}}{m^{2n} \cdot (2n)!} [f^{(2n)}(a+x) - f^{(2n)}(a)] \\&+ \dots, B_1, B_2, \dots \text{ being Bernoulli's numbers.}\end{aligned}$$

*In order to emphasize the importance of finding such an expression for the remainder after n terms as will hold good for all integral values of m and approach 0 as m approaches ∞ , and at the same time enable computers to determine absolutely in what cases the development holds, the proposer offers a prize of \$10 for the best solution. ED. F.

†See *Annals of Mathematics*, Second Series, Vol. 5, No. 4, July, 1904.

238. Proposed by PROF. R. D. CARMICHAEL, Anniston, Ala.

Solve the differential equations

$$\begin{aligned} (a) \quad & (x+y^2)dx + (x^2+y)dy = 0, \\ (b) \quad & (x+xy+y^2)dx - (x^2+xy-y)dy = 0. \end{aligned}$$

MECHANICS.

200. Proposed by C. N. SCHMALL, 89 Columbia Street, New York City.

An elastic string whose weight is W is laid over the top of an inclined plane so as to remain at rest. Determine how much the string will be elongated, knowing, M =modulus of elasticity, L =normal length of string, and ϕ =inclination of the plane.

201. Proposed by G. B. M. ZERR, Ph. D., Parsons, W. Va.

ABC is an inclined plane, perfectly rough, length $AC=l$. The time for a sphere to roll down when AB is base is to the time for a cylinder to roll down when BC is base as m is to n . Find AB and BC .

AVERAGE AND PROBABILITY.

187. Proposed by HENRY HEATON, Belfield, N. D.

Through every point of a given square straight lines are drawn in every possible direction, terminating in the sides of the square. What is the average length of such lines?

188. Proposed by J. EDWARD SANDERS, Reinersville, Ohio.

Find the average length of a hole at random through a given (a) sphere, (b) cube.

MISCELLANEOUS.

169. Proposed by E. D. ROE, Ph. D., Syracuse University, Syracuse, N. Y.

Find the value for all finite values of k of

$$\lim_{x \rightarrow \infty} \left[x^k \log \left(\frac{e^x + 1}{e^x - 1} \right) \right].$$

170. Proposed by J. W. NICHOLSON, A. M., LL. D., Baton Rouge, La.

If n and m are any two real numbers whatever, n being less than m , find a rational r such that $\sqrt[n]{n} < r < \sqrt[m]{m}$.